ORIGINAL RESEARCH PAPER

General Medicine

KEY WORDS: Sepsis; qSOFA; SIRS; Mortality prediction; Risk stratification; Organ dysfunction; Prospective study

qSOFA IN SEPSIS: SMALL SCORE, BIG IMPACT

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ABSTRACT

Background: Sepsis, defined by Sepsis-3 criteria as life-threatening organ dysfunction due to dysregulated host response to infection, remains a leading cause of hospital mortality, particularly in resource-limited settings. The quick Sequential Organ Failure Assessment (qSOFA) score comprising - altered mentation (Glasgow Coma Score <15), respiratory rate ≥22 breaths/min and systolic blood pressure ≤100 mmHg, offers rapid bedside risk stratification without laboratory requirements, addressing limitations of Systemic Inflammatory Response Syndrome (SIRS) criteria which demonstrate poor prognostic specificity. **Aim:** To study the predictive accuracy of Quick Sequential Organ Failure Assessment (qSOFA) score for assessing morbidity and mortality among the patients with sepsis at a tertiary care hospital in southwestern Maharashtra. **Materials And Methods:** This study was a prospective observational study conducted over 18 months at Krishna Hospital and Medical Research Centre, Karad, enrolling 111 adults (≥18 years) with confirmed sepsis. qSOFA and SIRS scores were calculated on admission. Data included demographics, comorbidities, infection sources, vital signs (systolic BP 96.7±15.8 mmHg; respiratory rate 24.9±4.2/min; GCS 13.6±1.9), laboratory parameters (lactate 3.2±1.1 mmol/L; creatinine 1.3±0.6 mg/dL), and outcomes (ICU admission, mechanical ventilation, mortality). Statistical analysis utilized Pearson correlation, logistic regression and diagnostic performance metrics (SPSS v26.0; p<0.05 significant). Institutional Ethics Committee approval and informed consents were obtained. **Results:** Participants comprised 60.4% males with mean age of 42.8±10.8 years; 67.6% had comorbidities (diabetes 19.8%). Respiratory infections predominated (35.1%). qSOFA distribution: score 1 - 29.7%, 2 - 49.5%, 3 - 20.7%. Clinical outcomes included ICU admission (95%), mechanical ventilation (80%), and mortality (42.3%; qSOFA 1: 6.1%; 2: 41.8%; 3: 95.7%). qSOFA demonstrated significant correlations with mortality (r=0.49, p=0.006) and ICU admission (r=0.58, p=0.001). Logistic regression identified altered mentation (OR 1.12, 95% CI 0.45-2.77, p<0.004), tachypnea (OR 4.15, 95% CI 1.82-9.48, p=0.003) and hypotension (OR 3.76, 95% CI 1.60-8.81, p=0.005) as independent mortality predictors. Compared to SIRS (sensitivity 89.1%, specificity 62.3%), qSOFA exhibited superior specificity (84.2%) and positive predictive value (70.2%). **Conclusion:** qSOFA demonstrates robust prognostic performance superior to SIRS for mortality risk stratification in sepsis patients within resource-constrained settings, supporting its integration into clinical workflows for timely triage and intervention.

INTRODUCTION:

Sepsis constitutes life-threatening organ dysfunction arising from a dysregulated host response to infection, as defined by Sepsis-3 criteria through a Sequential Organ Failure Assessment (SOFA) score increment of ≥2 points above baseline [1,2].

Sepsis accounts for approximately 49 million cases and 11 million deaths annually worldwide, representing nearly 20% of all global mortality, with a disproportionate burden in low- and middle-income countries (LMICs), including India, where in-hospital mortality ranges from 30–60% amid resource constraints [1,2].

In India, ~11 million annual sepsis episodes yield ~3 million fatalities, exacerbated by delayed presentations, suboptimal infrastructure and persistent reliance on outdated Systemic Inflammatory Response Syndrome (SIRS) criteria, which exhibit limited prognostic specificity (sensitivity 89.1% but specificity 62.3%) and precipitate over-triage [1,3].

The quick Sequential Organ Failure Assessment (qSOFA) score, comprising altered mentation (Glasgow Coma Scale <15), respiratory rate ≥22 breaths/min and systolic blood pressure ≤100 mmHg, was introduced in the 2016 Sepsis-3 guidelines as a parsimonious bedside surrogate for the SOFA score in non-ICU settings, eliminating the need for laboratory investigations and enabling rapid risk stratification (a qSOFA score ≥2 predicts increased mortality; specificity 84.2%, positive predictive value 70.2%). [1,4,5].

In resource-limited Southwestern Maharashtra (e.g., Satara district), qSOFA addresses endemic challenges such as ICU scarcity, delayed referrals and prevalent infections (respiratory 35.1%, urinary 22.5%, abdominal 16.2%), alongside common comorbidities including diabetes (19.8%) and chronic kidney disease (21.6%), which amplify vulnerability through impaired immunity and endothelial dysfunction [1,6].

This prospective observational study (n = 111) conducted at Krishna Hospital, Karad, evaluated the discriminative capacity of qSOFA for in-hospital morbidity (ICU escalation 95%, mechanical ventilation 80%) and mortality (42.3%, increasing from 6.1% at qSOFA = 1 to 95.7% at qSOFA = 3) in comparison with SIRS. qSOFA demonstrated superior prognostic precision, with significant correlations ($r = 0.49–0.58$, $p < 0.01$) and logistic regression analysis identifying altered mentation as the strongest predictor (OR 1.12, $p < 0.004$) [1]. These findings support the integration of qSOFA into triage protocols, with the potential to reduce sepsis-related mortality in comparable LMIC settings [2,3].

MATERIALS AND METHODS:

This prospective observational study evaluated the predictive accuracy of the quick Sequential Organ Failure Assessment (qSOFA) score for morbidity and mortality in sepsis patients at Krishna Hospital and Medical Research Centre, Karad, a tertiary care facility in Southwestern Maharashtra.

Conducted over 18 months, the study enrolled 111 adult patients (aged ≥18 years) who met the Sepsis-3 criteria, defined as suspected infection with acute organ dysfunction (an increase in SOFA score ≥2), and who presented within 24 hours of symptom onset.

Inclusion Criteria

- Adults aged ≥18 years.
- Patients with suspected or confirmed infection and organ dysfunction as per Sepsis-3 definition.
- qSOFA score obtainable at initial presentation, prior to the initiation of advanced organ-support intervention
- Written informed consent obtained from patient

Exclusion Criteria

- Patients aged less than 18 years
- Patients presenting with non-infectious causes of systemic inflammatory response such as major trauma, acute pancreatitis or extensive burns
- Patients already receiving mechanical ventilation or vasopressor/ionotropic support before initial qSOFA assessment
- Patients transferred from from other ICUs or with pre-existing chronic organ failure
- Patients unwilling or unable to provide consent
- Pregnant women and Lactating mothers

Study Design:

A prospective design facilitated real-time data capture from admission, enhancing accuracy over retrospective approaches.[87]

The sample size (n=111) was calculated using the formula (N

$= Z^2 * p * q / L^2$)

(Z=1.96 for 95% confidence, p=0.77 from prior studies, q=0.23, L=0.08), yielding 110.69, rounded to 111.

qSOFA scoring was applied bedside within 24 hours, prior to advanced interventions, alongside SIRS criteria for comparison

Study Procedure:
This prospective observational study followed a standardized protocol at Krishna Hospital and Medical Research Centre, Karad, from admission through discharge or death. All procedures adhered to the Sepsis-3 criteria and were approved by the Institutional Ethics Committee [4,5].

Patient Screening (Emergency Department/Ward Admission): Adult patients (≥18 years) with suspected or confirmed infection and acute organ dysfunction (an increase in SOFA score ≥2 points) were identified. Patients were excluded according to predefined criteria (e.g., pediatric cases, trauma patients, and those already receiving treatment).

Immediate Bedside Assessment (Within 24 Hours, Pre-intervention): qSOFA parameters—Glasgow Coma Scale (<15), systolic blood pressure (≤100 mmHg), and respiratory rate (≥22 breaths/min)—were recorded prior to the initiation of antibiotics, intravenous fluids, vasopressors, or mechanical ventilation. SIRS criteria were assessed concurrently.

Informed Consent:
Written informed consent was obtained from the patient or a legally authorized guardian after explaining the study objectives, potential risks and the right to voluntary withdrawal.

Baseline Data Capture:
Patient demographics, comorbidities, vital signs (temperature, heart rate, SpO), site of infection and laboratory parameters (CBC, creatinine, lactate, albumin) were documented using a predesigned proforma.

Prospective Follow-Up:
Patients were monitored daily until discharge or death for clinical outcomes, including ICU escalation, mechanical ventilation, vasopressor or inotrope requirement, prolonged length of stay (>7 days) and in-hospital mortality.

Data Management And Analysis:
Anonymized data were entered into Microsoft Excel and analyzed using SPSS version 26. Descriptive statistics, chi-square tests and logistic regression analyses were performed, with p-values <0.05 considered statistically significant.

Statistical Analysis:
Statistical analyses were performed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA), with preliminary data management in Microsoft Excel. Descriptive statistics summarized categorical variables (e.g., qSOFA scores, demographics, clinical outcomes) as frequencies and percentages, and continuous variables (e.g., age, vital signs, laboratory values) as means ± standard deviations. For example, qSOFA scores among the 111 patients were distributed as 29.7% (score 1), 49.5% (score 2), and 20.7% (score 3).

Inferential analyses included Chi-square tests to assess associations between dichotomized qSOFA scores (≥2 vs. <2) and binary outcomes such as ICU admission and mortality. Pearson correlation coefficients were calculated to examine relationships between qSOFA scores and clinical outcomes (e.g., r = 0.52 for ICU admission, p = 0.003). Logistic regression analyses evaluated the predictive value of individual qSOFA parameters for mortality (e.g., respiratory rate ≥22/min: OR 4.15, 95% CI 1.82–9.48, p = 0.003).

Diagnostic performance of qSOFA was compared with SIRS criteria. qSOFA demonstrated a sensitivity of 78.3%, specificity of 84.2%, positive predictive value (PPV) of 70.2%, and negative predictive value (NPV) of 89.1%, whereas SIRS showed higher sensitivity (89.1%) but lower specificity (62.3%). Statistical significance was defined as $p < 0.05$ for all tests, confirming the superior prognostic specificity of qSOFA in this sepsis cohort.

RESULTS:

Demographic Characteristics

A total of 111 patients with sepsis were included in the study. Most participants were aged above 45 years, with 27.9% in the 46–60 years age group and 27.9% over 60 years. Patients aged 18–45 years comprised 45.0% of the cohort. There was a male predominance, with males accounting for 60.4% of the study population.

Table 7.1: Age Group And Gender Distribution Of Study Participants

Demographic Variable	Category	Frequency (n)	Percentage (%)
Age Group (years)	18–30	22	19.8%
	31–45	28	25.2%
	46–60	30	27.0%
	>60	31	27.9%
Gender	Male	67	60.4%
	Female	44	39.6%

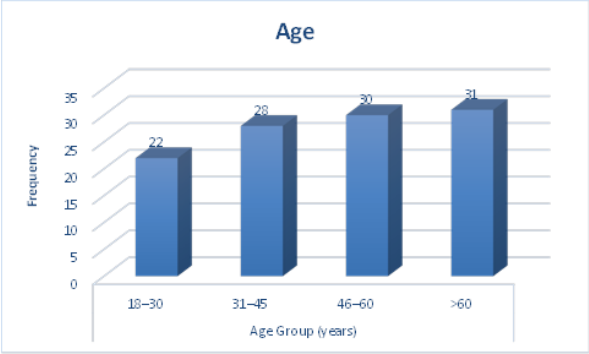

Fig 7.1: Distribution Of Age Among Respondents

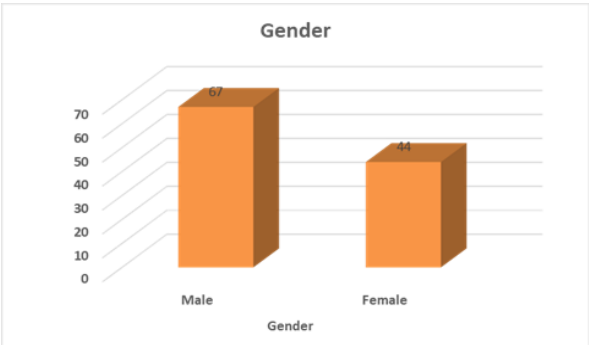

Fig 7.2: Distribution Of Gender Among Respondents

Table 7.2: Comorbidities Among Study Participants

Variable	Category	Frequency (n)	Percentage (%)
Comorbidities	None	36	32.4%
	Diabetes Mellitus	22	19.8%
	Hypertension	17	15.3%
	COPD/Asthma	12	10.8%
	CKD/Other chronic illness	24	21.6%

Comorbidities

Comorbid conditions were present in 67.6% of patients. Diabetes mellitus was observed in 19.8%, hypertension in 15.3%, chronic kidney disease or other chronic illnesses in 21.6%, and chronic obstructive pulmonary disease or asthma in 10.8%. No comorbidities were reported in 32.4% of patients.

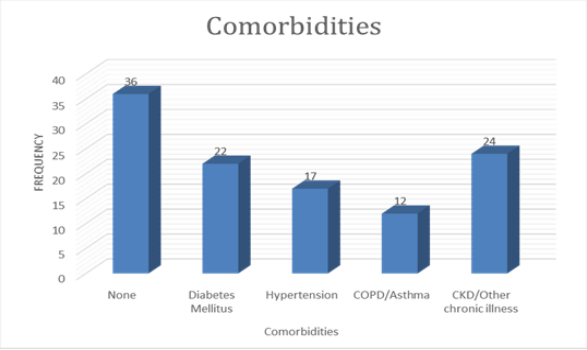

Fig 7.3: Distribution Of Comorbidities Among Respondents

Site Of Infection

Respiratory tract infections were the most common source of sepsis, accounting for 35.1% of cases, followed by urinary tract infections in 22.5%. Abdominal infections and other or unknown sources each accounted for 16.2%, while skin and soft tissue infections were observed in 9.9% of cases.

Table 7.3: Distribution Of Site Of Infections Among Respondents

Variable	Category	Frequency (n)	Percentage (%)
Site of Infection	Respiratory	39	35.1%
	Urinary tract	25	22.5%
	Abdominal	18	16.2%
	Skin Soft tissue	11	9.9%
	Others/Unknown	18	16.2%

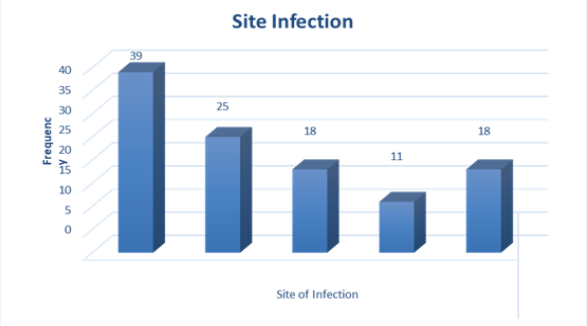

Fig 7.4: Distribution Of Site Of Infection Among Respondents

Clinical Parameters and Laboratory Findings at Admission

At presentation, the mean body temperature was 38.4 ± 1.2°C, mean respiratory rate was 24.9 ± 4.2 breaths/min, and mean systolic blood pressure was 96.7 ± 15.8 mmHg. The mean oxygen saturation was 89.3 ± 5.7%, and the mean Glasgow Coma Scale (GCS) score was 13.6 ± 1.9.

Laboratory evaluation showed a mean total leukocyte count of 14.8 ± 5.6 × 10^3/μL and a mean platelet count of 210 ± 65 × 10^3/μL. Mean serum creatinine was 1.3 ± 0.6 mg/dL, serum lactate 3.2 ± 1.1 mmol/L, and serum albumin 3.5 ± 0.4 g/dL.

Table 7.4: Baseline Vital Signs Of Patients At Admission

Parameter	Mean ± SD
Temperature (°C)	38.4 ± 1.2
Respiratory Rate (per min)	24.9 ± 4.2
Systolic BP (mmHg)	96.7 ± 15.8
Oxygen Saturation (%)	89.3 ± 5.7
GCS Score	13.6 ± 1.9

Table 7.5: Baseline Laboratory Parameters Of Patients At Admission

Parameters	Mean ± SD
WBC Count (x10^3/μL)	14.8 ± 5.6
Platelet Count (x10^3/μL)	210 ± 65
Serum Creatinine (mg/dL)	1.3 ± 0.6
Serum Lactate (mmol/L)	3.2 ± 1.1
Serum Albumin (g/dL)	3.5 ± 0.4

Distribution Of qSOFA Scores

Based on qSOFA scoring, 29.7% of patients had a score of 1, 49.5% had a score of 2, and 20.7% had a score of 3. Overall, approximately 70% of patients had a qSOFA score ≥2.

Table 7.6: Distribution Of qSOFA Scores Among Study Population

qSOFA Score	Frequency	Percent
1	33	29.7
2	55	49.5
3	23	20.7

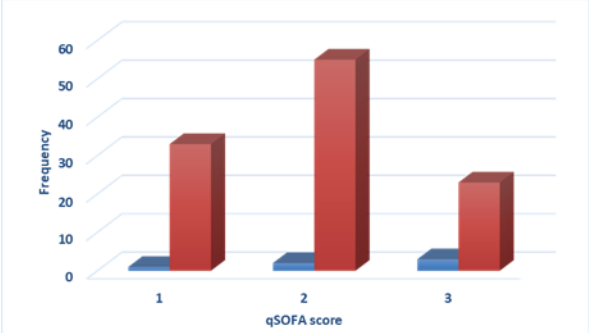

Fig 7.5: Graphical Illustration Of qSOFA Scores Among Study Population.

Mortality According To qSOFA Score

Mortality increased with rising qSOFA scores. Among patients with a qSOFA score of 1, mortality was 6.1%. Mortality increased to 41.8% in patients with a qSOFA score of 2 and was highest among those with a score of 3, at 95.7%.

Table 7.8: Distribution Of Mortality According To qSOFA Score

qSOFA Score	Total Patients (n)	Deaths	Mortality (%)
1	33	2	6.1%
2	55	23	41.8%
3	23	22	95.7%
Total	111	47	—

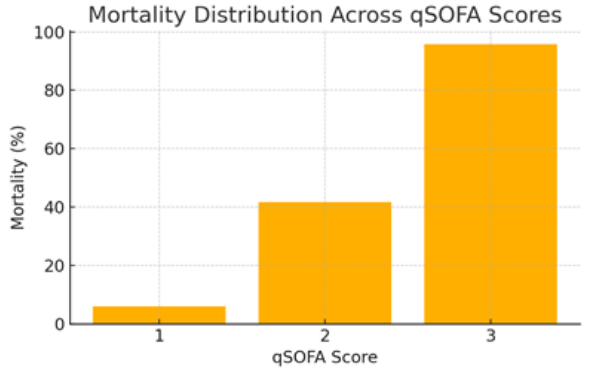

Fig 7.7 Mortality Distribution Across qSOFA scores

Clinical Outcomes

A total of 105 patients (95.0%) required intensive care unit (ICU) admission, and 95 patients (80.0%) required

mechanical ventilation. The overall in-hospital mortality rate was 42.3%, while 57.7% of patients survived and were discharged.

Table 7.10: Clinical Outcomes Observed Among The Study Population

Clinical Outcome	Frequency (n)	Percentage (%)
ICU Admission	105	95%
Mechanical Ventilation	95	80%
Mortality	47	42.3%
Morbidity	64	57.7%

DISCUSSION:

Defined as a dysregulated host response to infection leading to life-threatening organ dysfunction, sepsis remains a formidable global health challenge. Despite advances in antimicrobial therapy, critical care monitoring and organ support, sepsis continues to be associated with high morbidity and mortality worldwide. This burden is especially pronounced in low- and middle-income countries, where delayed presentation, diagnostic limitations and restricted access to intensive care impede timely intervention. In this context, the present study aimed to evaluate the clinical profile of sepsis and assess the prognostic performance of the quick Sequential Organ Failure Assessment (qSOFA) score as a simple bedside risk stratification tool in a tertiary care hospital in Southwestern Maharashtra.

Analysis of the demographic profile revealed a predominance of patients aged over 45 years, highlighting advancing age as a significant risk factor for severe sepsis and adverse outcomes. This finding aligns with previous studies by **Meyer et al.** [90] and **Opal et al.** [91], which reported increased sepsis incidence and mortality among the elderly. Age-related immune senescence, reduced physiological reserve, endothelial dysfunction and accumulation of comorbidities collectively impair the host's ability to mount an effective immune response, predisposing older patients to rapid clinical deterioration and poorer outcomes [92].

A male predominance was observed in the present cohort, with males comprising 60.4% of cases. This finding aligns with previous reports by Shields and Wang [93] and Angele et al. [94], which documented sex-based disparities in immune regulation and susceptibility to severe infections. Hormonal influences, genetic modulation of immune responses and socio-behavioral factors have been proposed to explain the higher incidence and poorer prognosis of sepsis among males.

Comorbid conditions were highly prevalent in the study population, with diabetes mellitus, hypertension, chronic kidney disease, and other chronic illnesses being the most frequently encountered. These observations are consistent with reports by **Thimmappa et al.** [95] and Frydrych et al. [96], highlighting the role of chronic diseases in compromising innate and adaptive immune mechanisms. For instance, diabetes mellitus impairs neutrophil chemotaxis, phagocytosis and cytokine responses, while chronic kidney disease is associated with immune dysregulation, persistent inflammation and altered pharmacokinetics of antimicrobial agents. The presence of multiple comorbidities complicates the clinical course of sepsis and underscores the need for structured, reliable prognostic tools such as qSOFA.

Respiratory tract infections emerged as the most common source of sepsis, followed by urinary tract and abdominal infections. This distribution is consistent with epidemiological data reported by **Cookson et al.** [97], who identified pneumonia as the leading cause of sepsis globally. The extensive vascular and lymphatic networks of the lungs facilitate rapid dissemination of inflammatory mediators, contributing to early systemic involvement and organ dysfunction. The contribution of urinary tract and intra-abdominal infections further highlights the heterogeneous infectious etiologies of sepsis and underscores the importance of early empiric broad-spectrum antimicrobial therapy.

Clinically, patients commonly presented with classical manifestations of systemic inflammation, including fever, tachypnea, tachycardia, hypotension and hypoxemia. Neurological dysfunction was particularly prominent, with a substantial proportion of patients exhibiting altered mental status and a mean Glasgow Coma Scale score of 13.6. These findings are consistent with those of **Fan et al.** [98], who described sepsis-associated encephalopathy as an early and clinically significant manifestation of systemic inflammation. Disruption of cerebral microcirculation, blood–brain barrier integrity and neuroinflammatory pathways contribute to altered sensorium and are strongly associated with adverse prognostic outcomes.

Laboratory investigations further substantiated the severity of systemic involvement, with leukocytosis, elevated serum lactate levels and early renal dysfunction being commonly observed. Elevated lactate has been widely validated as a marker of tissue hypoperfusion and anaerobic metabolism and is strongly associated with increased mortality, as documented by **Srivastava et al.** [99]. Early renal impairment observed in the present study likely reflects evolving organ dysfunction within the sepsis continuum.

The qSOFA score demonstrated robust prognostic utility in the present cohort. Nearly half of the patients had a qSOFA score of 2, while more than one-fifth scored 3, identifying a high-risk subgroup. Logistic regression analysis identified altered mental status as the strongest independent predictor of mortality, followed by tachypnea and hypotension. These findings are concordant with validation studies by **Rudd et al.** [100] and Berger et al. [101], which emphasized the prognostic significance of neurological and cardiovascular derangements in sepsis.

When compared with the Systemic Inflammatory Response Syndrome (SIRS) criteria, qSOFA exhibited superior specificity and positive predictive value, while SIRS retained higher sensitivity and negative predictive value. This observation mirrors the findings of **Hari and Harrison** [102], who suggested that SIRS may be useful for broad early screening, whereas qSOFA is better suited for prognostication and prioritization of high-risk patients. The complementary use of both tools may therefore enhance clinical decision-making and optimize resource allocation, particularly in high-burden, resource-constrained settings.

Clinical outcomes in the present study were severe, with high rates of intensive care unit admission, mechanical ventilation, and an overall mortality of 42.3%. These outcomes are comparable to those reported by **Ranjit and Kissoon** [103] and **Schultz et al.** [104], particularly in low- and middle-income countries. Delayed presentation, diagnostic challenges, limited critical care infrastructure and variability in adherence to sepsis management protocols likely contribute to these persistently high mortality rates. The wide heterogeneity of presenting symptoms further underscores the syndromic nature of sepsis and highlights the need for standardized assessment frameworks.

Correlation analysis revealed a strong association between increasing qSOFA scores and adverse clinical outcomes, including ICU admission, ventilatory support and mortality, reaffirming its prognostic relevance [105,106]. Early neurological deterioration emerged as a critical determinant of outcome, supporting prior recommendations emphasizing meticulous neurological assessment in sepsis management.

The persistently high mortality observed in this study aligns

with global estimates reported by international sepsis task forces, which indicate ICU mortality rates ranging from 30% to 50% in developing countries [123]. These findings underscore the urgent need for improved early recognition, standardized triage strategies and adherence to evidence-based sepsis management bundles. Future research integrating clinical scoring systems such as qSOFA with emerging biomarkers and nutritional parameters may further enhance precision in risk stratification and outcome prediction

LIMITATIONS:

The present study has certain limitations. Being a single-center study, the findings may not be fully generalizable to other healthcare settings. The relatively small sample size may have limited the statistical power and precision of subgroup analyses. As an observational study, causal relationships between qSOFA scores and clinical outcomes could not be established and potential confounding factors related to variations in management could not be completely controlled. Additionally, serial qSOFA assessments and comparisons with other prognostic scoring systems such as SOFA or APACHE II were not performed.

Despite these limitations, the study provides meaningful evidence regarding the clinical utility of qSOFA as a simple bedside prognostic tool in patients with sepsis

CONCLUSION:

Sepsis continues to represent a significant global health burden, with disproportionately high morbidity and mortality in resource-limited healthcare settings where early recognition and timely escalation of care are often constrained. The findings of the present study affirm that the quick Sequential Organ Failure Assessment (qSOFA) score is a practical, rapid and reliable bedside tool for early risk stratification in patients presenting with sepsis. Higher qSOFA scores were strongly associated with adverse clinical outcomes, including increased requirements for intensive care unit admission, mechanical ventilatory support and mortality.

Among the individual components of qSOFA, altered mental status emerged as the most powerful independent predictor of mortality, highlighting the critical prognostic value of early neurological assessment in septic patients. Although the Systemic Inflammatory Response Syndrome (SIRS) criteria demonstrated higher sensitivity, qSOFA exhibited superior specificity and positive predictive value, enabling more accurate identification of patients at high risk for clinical deterioration and death [100,102].

The elevated mortality rate observed in this study underscores the persistent severity of sepsis in developing countries and emphasizes the urgent need for simple, bedside assessment tools to support early clinical decision-making and optimal resource utilization [103,104,123]. Routine integration of qSOFA into emergency and ward-based evaluations may facilitate prompt identification of high-risk patients and improve outcome-oriented care delivery. Further large-scale, multicentric prospective studies are warranted to validate these findings and to define the role of qSOFA within standardized sepsis management protocols across diverse healthcare settings.

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